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Abstracts

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Validation of two high-resolution climate simulations over Scandinavia

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Before running climate projections with numerical models it is important to validate their performance under present climate conditions. Within the RiskChange project two high-resolution regional climate models were run as a perfect boundary experiment over Scandinavia. The simulations are validated with respect to timing, location and intensity of extreme events. The main objective of the RiskChange project (www.riskchange.dhigroup.com) is to establish a consistent scientifically-based framework for risk-based design using state-of-the-art knowledge of future changes in climate extreme statistics. Very high resolution is required in impact models that are employed to address particular societal needs and risks in terms of adaptation to future climate challenges, (e.g. future storm surge protection of coastlines and low-level lands or drainage systems in urban areas). The purpose of this study is to analyse the properties of high-resolution climate simulations over Scandinavia by testing a hypothesis that dynamic simulations are better at retaining the properties of precipitation, notably precipitation extremes than coarser simulations. When compared to statistical methods the dynamical downscaling has the advantage of retaining the full set of atmospheric variables as well as a physically more realistic description of e.g. complex terrain (e.g. mountain ranges and coastlines) and when the representation and behaviour of extremes are important to be captured in a realistic manner. Here, we present a set of two high-resolution dynamical downscaling simulations on an 8 km grid. Before performing climate simulations under future emission scenarios, it is crucial to validate the model performance under present-day climate conditions to identify systematic biases within the models (Jacob et al., 2007) and to evaluate to what degree the models simulate observed weather. This is done by performing a so-called perfect boundary experiment by dynamically downscaling ERA interim data. The atmospheric models WRF and HIRHAM5 were used as regional climate models (RCMs) in this study. Both models were initialized and driven at their lateral boundaries with ERA-interim data. The simulation period covers 1989-2010 with the first year considered spin-up and discarded. As observational reference we have used both gridded data (E-OBS, Haylock et al., 2008) as well as station observations. Various methods are employed to examine the performance of the RCMs behaviour on a seasonal to sub-daily time scale. Both models exhibit a wet bias of 50-100 % (1-3 mm) in seasonal precipitation. This bias is most pronounced during winter. The lower-resolution reanalysis data underestimates wet-day precipitation in all four season by 13-36 % over the selected cities Bergen, Oslo and Copenhagen. The RCM simulations show a reduction of this underestimation and even indicate a sign change in some seasons/locations. A spatio-temporal evaluation of downscaled precipitation extremes shows that both RCM downscalings are much closer to the observational behaviour. The analysis of higher-order statistical models indicates that short duration extreme precipitation during summer is better simulated within both models.

Haylock, M.R and co-authors (2008) A European daily high-resolution gridded dataset of surface temperature and precipitation, J. Geophys. Res. (Atmospheres), 113, D20119 Jacob, D. and co-authors (2007) An inter-comparison of regional climate models for Europe: model performance in present-day climate, Clim. Change, 81(1), 31-52